An approach to assessing comparative ecological condition of

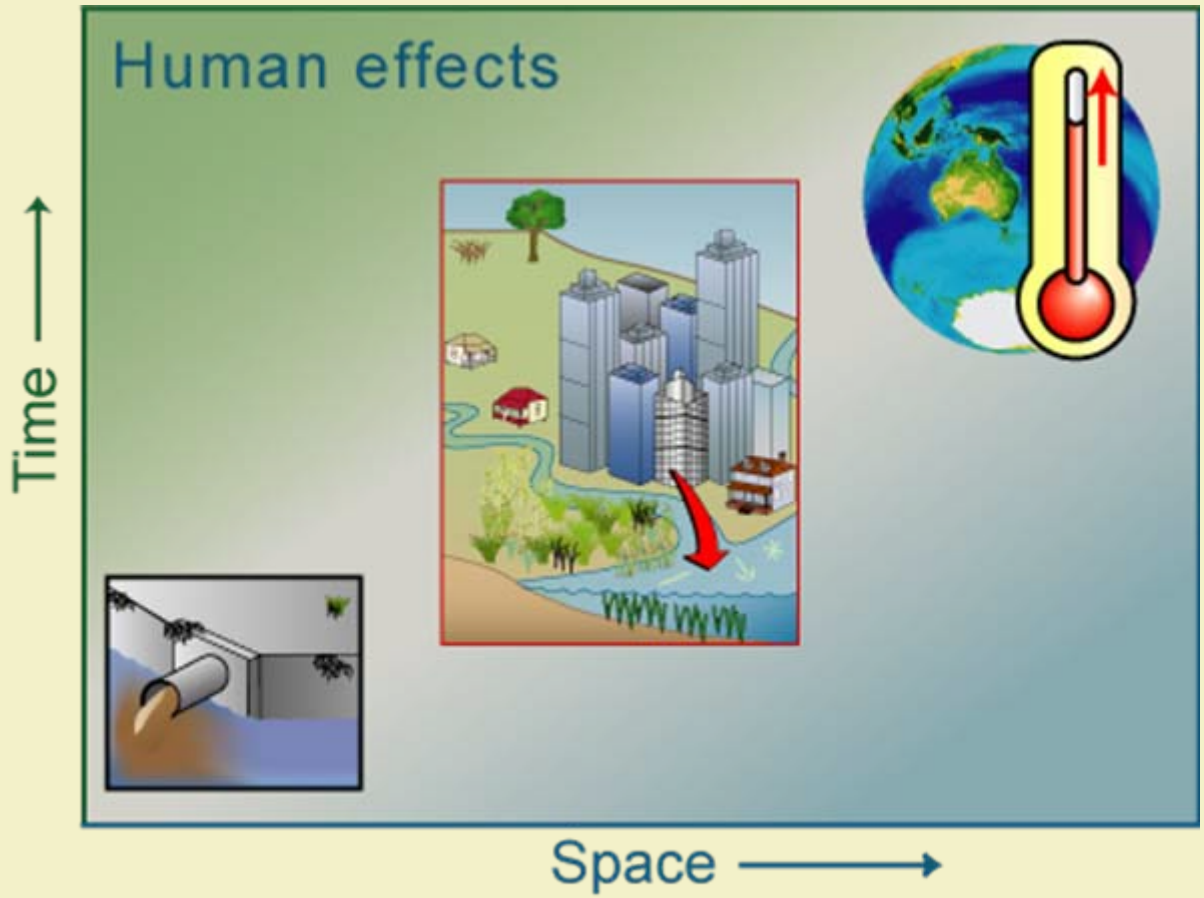
National Capital Region parks

May 2005

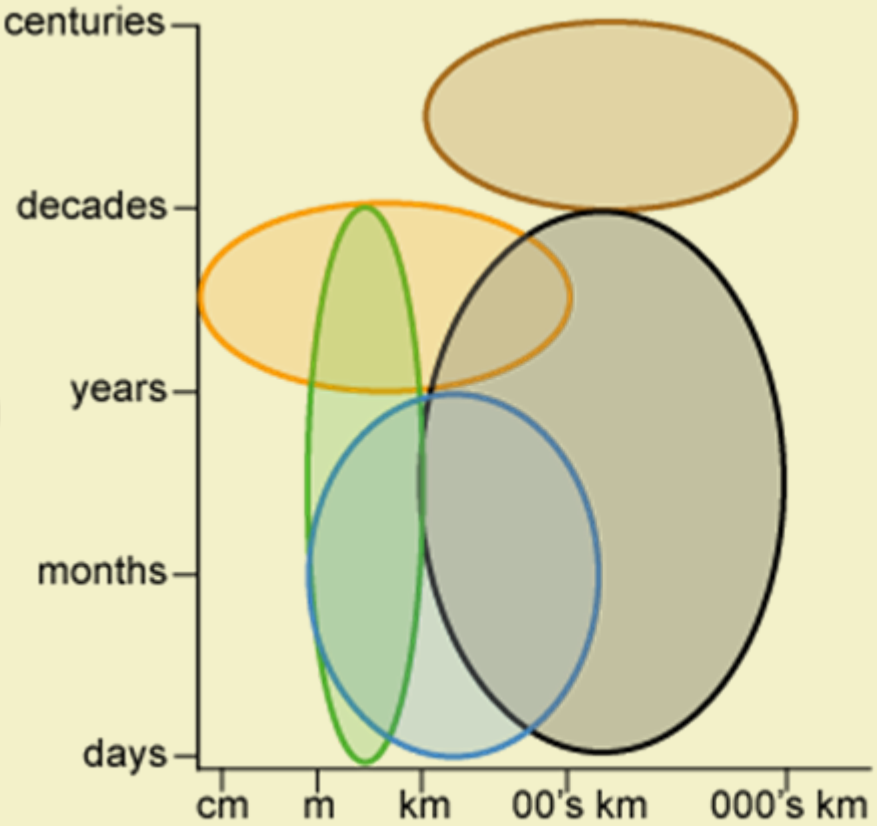
Human impacts at different scales

- Human impacts occur over a wide range of spatial and temporal scales

- Point sources (small:small)
- Impervious surface (medium:medium)
- Gobal warming (large:large)



Vital signs require monitoring at different spatial and temporal scales




Air and Climate


Geology and soils

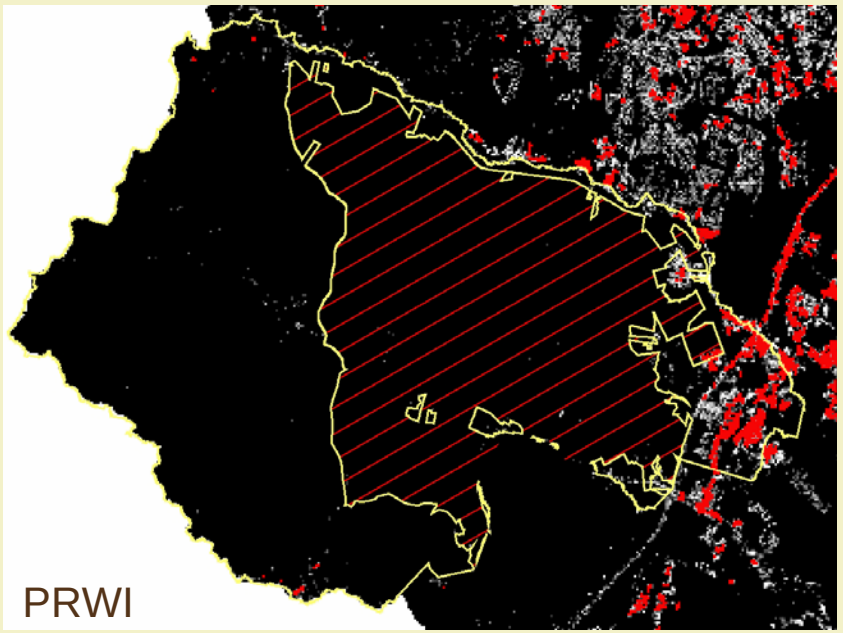

Water


Biological Integrity


Ecosystem pattern and processes

Challenges…

- Different scales of stressors (atmospheric inputs vs deer populations)
- Different features (WOTR vs CATO)
- Different park sizes (CHOH vs ROCR)
- Parks spatially divided (eg NACE)
- Balance of terrestrial and aquatic habitats
- Different physiographic regions (PRWI vs CATO)



Solution 1: Park classification for consistent assessment between parks

- Natural Resource Parks
  Parks: PRWI, CATO, ROCR
  Vital signs: air, geology, water, biological integrity, ecosystem process

- Battlefield
  Parks: MONO, ANTI, MANA, HAFE
  Vital signs: air, geology, water, biological integrity, ecosystem process

- Monument
  Parks: CHOH, GWMP, NACE, WOTR
  Vital signs: air, water

- Recognizing that all parks have some natural resources

Proof of concept: comparison of four parks in National Capital Region

- ANTI
- ROCR
- PRWI
- CATO

Ecosystem Health Index: Including measures of…

- Ecosystem Processes
- Water Quality
- Air Quality

Antietam National Battlefield (ANTI)

Park area:
13,161 ha

Watershed area (outside):
17,633 ha
716,178 ha (Anti Creek)

Physiographic region:
Ridge and Valley

Visitors 2004:
236,840

Rock Creek National Park (ROCR)

Park area:
7,116 ha

Watershed area (outside):
181,328 ha

Physiographic region:
Coastal plain, Piedmont

Visitors 2004:
2,148,970

Prince William Forest Park (PRWI)

Park area:
50,549 ha

Watershed area (outside):
59,345 ha

Physiographic region:
Coastal plain, Piedmont

Visitors 2004:
216,039

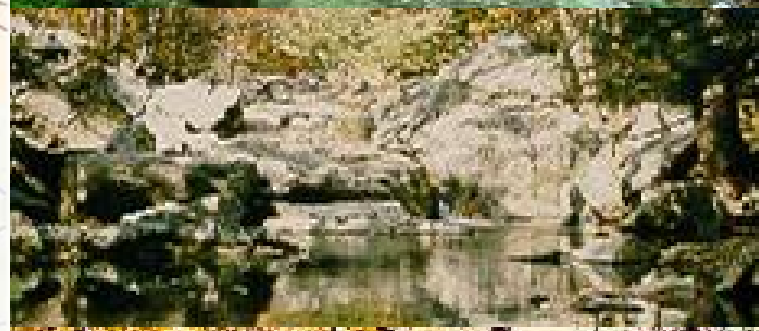
Catoctin Mountain Park (CATO)

Park area:
22,772 ha

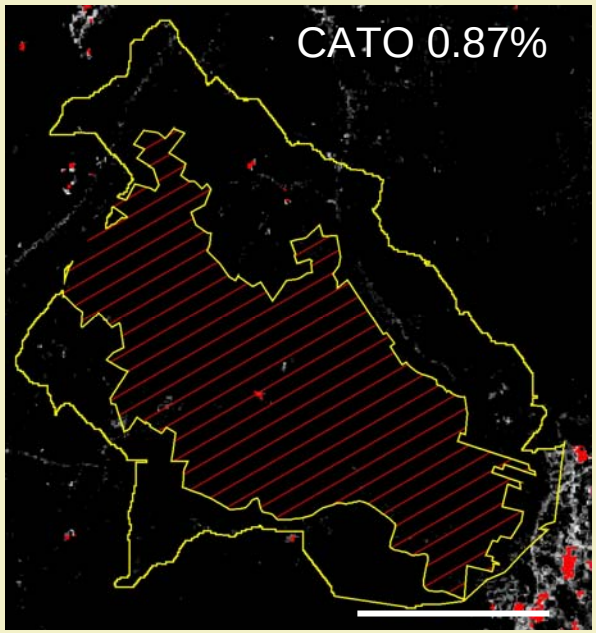
Watershed area (outside):
22,387 ha

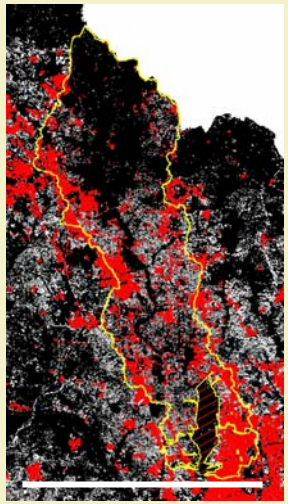
Physiographic region:
Blue Ridge,
Ridge and Valley

Visitors 2004:
734,189

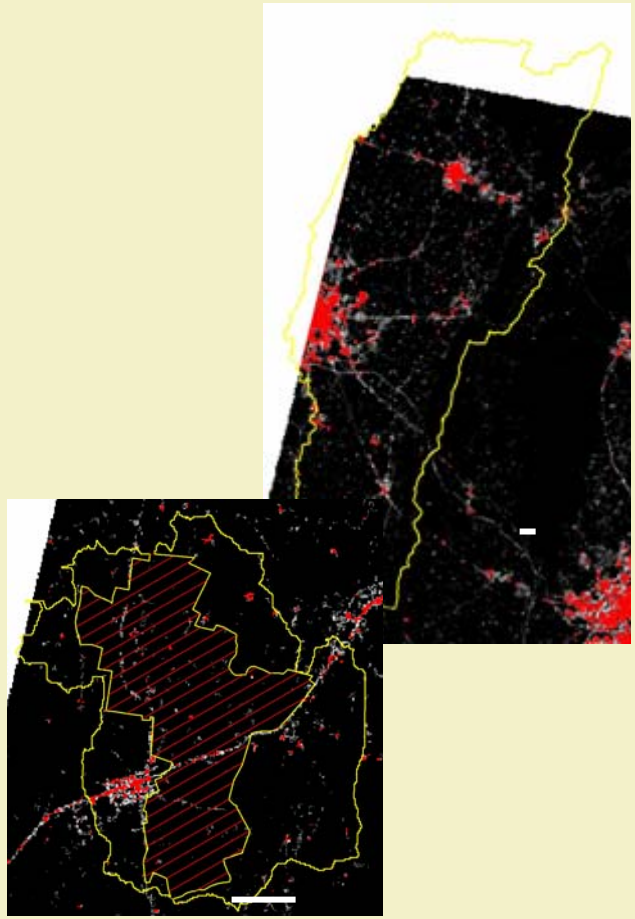


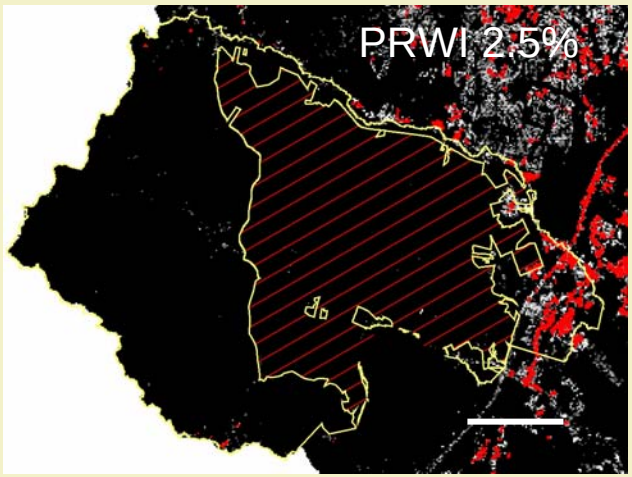
Example of impervious surface





ROCR 23.45%





Impervious surface

Scale bar approx 1 mile

ANTI 2.41%

Health threshold: < 10% impervious

Ecological link to vital sign measurement (justification for 10% impervious cover threshold)

- increased floods and flood peaks, leading to stream straightening and streambed erosion;
- increased erosion, leading to loss of trees and vegetation along the banks (at 8% - 10% impervious surface cov, streams double in the size of the bed due to the increased vol);
- increased pollutant loads;
- increased shellfish diseases and beach closures;
- increase in stream temperature which messes up lots of biological processes;
- increased bacteria, often as a direct of a high density of household pets;
- decreased high weather flow;
- decreased pooling;
- decreased woody debris, a crucial habitat element for aquatic insects;
- decrease in substrate quality;
- decreased fish passage during dry weather flow periods due to the enlarged stream bed; and
- decrease in insect fish and fish diversity. At 12% imperviousness, trout and other sensitive species can no longer survive in the stream.

Impervious cover – relative to threshold

Park	Impervious cover watershed (%)	Attainment of threshold
ANTI	2.41	1
ROCR	23.45	0
PRWI	2.50	1
CATO	0.87	1

Summary of vital signs between parks

Park	 Impervious cover watershed (%)	 Modelled Ozone (ppb)	 Deer density # km^2
ANTI	2.41	76-85	35.1
ROCR	23.45	92-97	23.9
PRWI	2.50	86-91	15.5
CATO	0.87	86-91	71.3
Threshold	<10%	<80 (8 hr mean 4th highest over 3 yr)	<10 forest <30 battlefield

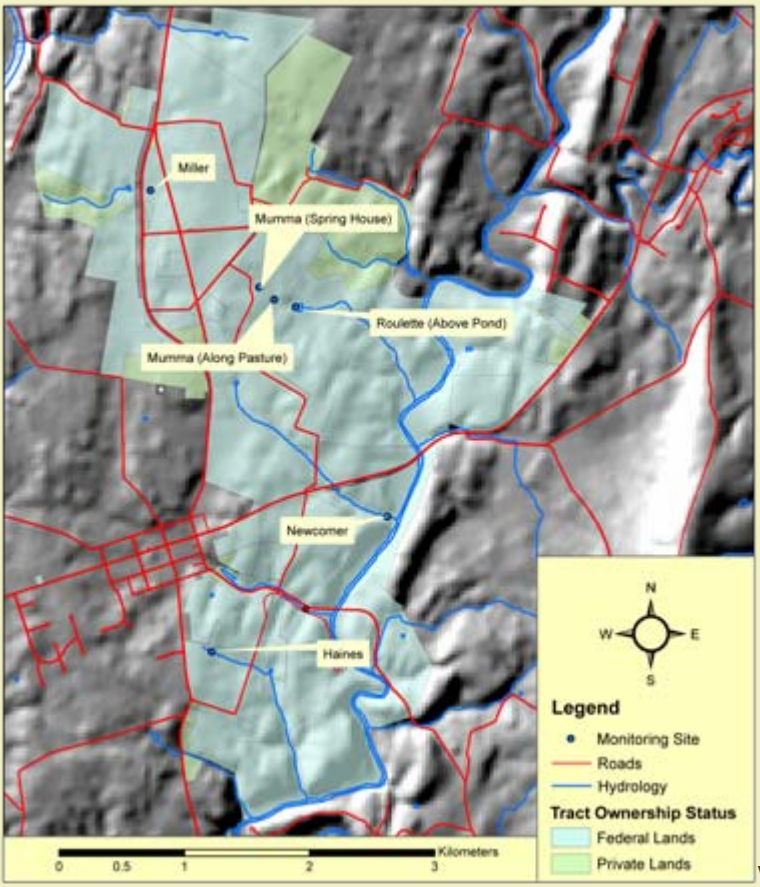
Calculation of health on known values/four park comparison

Park	Impervious cover watershed (%)	Modelled Ozone (ppb)	Deer density # km^2	Summary health
ANTI	1	1	0	**0.66**
ROCR	0	0	0	**0.00**
PRWI	1	0	0	**0.33**
CATO	1	0	0	**0.33**
Threshold	<10%	<80 (8 hr mean 4th highest over 3 yr	<10 forest <30 battlefield	

Where Ecosystem health of 1 indicates attainment of all measured vital signs
Ecosystem health of 0 indicates attainment of no measured vital signs

Note this 'health' is obviously biased by example indicators –
10-15 broad indicator measurements would be ideal

Effective management also requires knowledge of within park variations - ANTI



Site	pH	DO (mg/L)	NO_3^- (mg/L)	PO_4^{3-} (mg/L)
Haines Farm	7.12	5.50	5.60	0.20
Miller Farm	7.17	8.48	8.70	0.21
Newcomer Farm	7.91	8.86	2.90	0.14
Above Pond	7.96	8.16	5.60	0.23
Mumma pasture	7.87	8.92	5.40	0.26
Mumma house	7.11	5.10	7.70	0.17
Threshold	**6.5-9.0**	**>5.5**	**<10**	**<0.1**

Values are annual medians for 2003

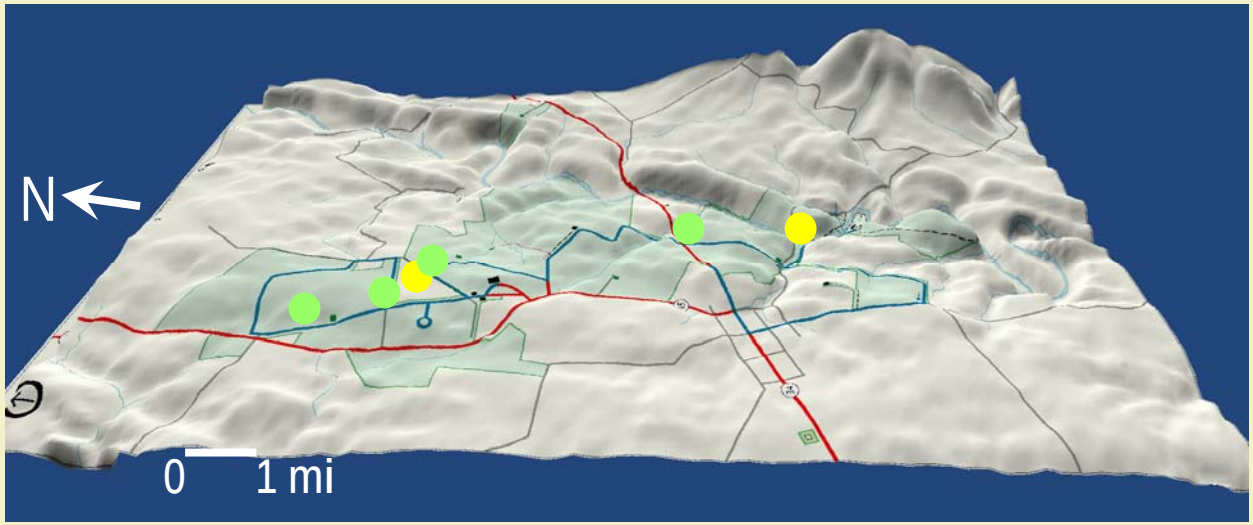
Thresholds from Runde, EPA nutrient standards summary

Water quality health comparison within ANTI

Site	pH	DO (mg/L)	NO_3^- (mg/L)	PO_4^{3-} (mg/L)	Summary Water quality
Haines Farm	1	0	1	0	0.5
Miller Farm	1	1	1	0	0.75
Newcomer Farm	1	1	1	0	0.75
Above Pond	1	1	1	0	0.75
Mumma pasture	1	1	1	0	0.75
Mumma house	1	0	1	0	0.5
Threshold	**6.5-9.0**	**>5.5**	**<10**	**<0.1**	

Water quality health comparison within ANTI

Site	Summary Water quality
Haines Farm	0.5
Miller Farm	0.75
Newcomer Farm	0.75
Above Pond	0.75
Mumma pasture	0.75
Mumma house	0.5



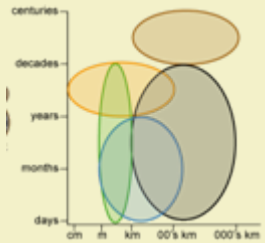
- 0.00 attained no water quality criteria
- 0.25
- 0.50
- 0.75
- 1.00 attained all water quality criteria

Recommendations

- Require a subset of parameters linked to key vital signs that can be **Modeled**, **Measured**, **Mapped** and **Thresholds establishment**

- Parks should be classified into broad categories to distinguish the largest differences present in structure and ecological function – eg Natural resource, Battlefield and Monument Parks

- Measurements should be taken at consistent temporal scales to allow direct comparison between parks – scales must be appropriate to parameters



- Within parks, assessment should be made to identify local management priorities

Acknowledgements

- Shawn Carter
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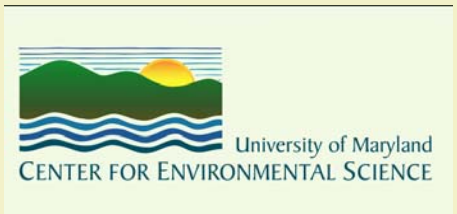

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